Total Maximum Daily Load Implementation Plan for the Chowan Study Area
(Nottoway Study Area)
Executive Summary

Submitted to:

The Stakeholders of the
Upper Nottoway River Watershed
On Behalf of
The Commonwealth of Virginia
Department of Environmental Quality and
Department of Conservation and Recreation

June 27, 2005

Submitted By:

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Also available for this project:
A Total Maximum Daily Load Implementation Plan for the Chowan Study Area (Technical Report)

Introduction

Virginia's 1998 *303(d) TMDL Priority List* included Beaverpond Creek and Nottoway River due to violations of the State's water quality standard for fecal bacteria. In the 2002 *Section 303(d) Report on Impaired Waters*, Big Hounds Creek and Little Nottoway River were also listed for fecal impairments. Beaverpond Creek, Big Hounds Creek, Little Nottoway and Nottoway River are all part of the Upper Nottoway River Basin. For the purposes of this report, we will refer to this as the Nottoway Study Area.

Fecal coliform and *E. coli* are used as indicators of fecal pollution which indicate the presence of microorganisms that are harmful to humans. Fecal coliform and *E. coli* are used as indicators because they are found in the intestinal tract of warm-blooded animals. *E. coli* is one member of the fecal coliform group of bacteria.

Inclusion on the 303(d) lists indicates that these streams exceeded the water quality standard in more than 10% of the samples collected during an assessment period. As a result, Total Maximum Daily Loads (TMDLs) were developed for these streams. The TMDL is the maximum amount of pollutant that a water body can assimilate without exceeding the state water quality standard. After TMDL Plans are written, Virginia's 1997 Water Quality Monitoring Information and Restoration Act (Section 62.1-44.19:7) states that the "Board shall develop and implement a plan to achieve fully supporting status for impaired waters". In fulfilling the state's requirement for the development of a TMDL Implementation Plan (IP), a framework was established for reducing fecal bacteria and achieving the water quality goals for each impaired segment. With successful completion of the IP, the Nottoway Study Area will be well on the way to meeting these water quality goals, and natural resources will be enhanced. Additionally, approval of the IP will increase the opportunities for funding during implementation.

Questions & Comments

Key components of the implementation plan are discussed in the following sections:

- ◄ Background
- ◄ Review of the TMDL Document
- ◄ Process for Public Participation
- ◄ Assessment of Needs
- ◄ Cost/Benefit Analysis, and
- ◄ Implementation

Background

The detrimental effects of bacteria in food and water supplies have been documented time and again. In Franklin County, Virginia, a 1997 outbreak of illnesses involving three children was attributed to *E. coli* (0157:H7) in Smith Mountain Lake. The children were exposed to the bacteria while swimming in the lake. A two-year-old child was hospitalized and almost died as a result of the exposure (Roanoke Times, 1997). In August 1998, seven children and two adults at a day-care center in rural Floyd County were infected with *E. coli* (0157:H7). Upon investigation, two of the property's wells tested positive for total fecal coliform (Roanoke Times, 1998). On June 6, 2000, Crystal Spring (Roanoke, Virginia's second largest water source) was shut down by VDH for *E. coli* contamination.

Isolated cases? No. Throughout the United States, the Centers for Disease Control estimates that at least 73,000 illnesses and 61 deaths *per year* are caused by coliform pathogens (*i.e., E. coli* 0157:H7 bacteria) (CDC, 2001). In addition, other bacterial and viral pathogens are indicated by the presence of *E. coli* and can be responsible for similar illnesses. Whether the source of contamination is human or livestock, the risk of sickness from contact with these pathogens appears more prevalent as both populations increase. As stakeholders, we must assess the risk we are

willing to accept and then implement measures to safeguard the public from these risks. Water quality standards are society's implementation of legislative measures resulting from an assessment of the acceptable risks.

This booklet is an abbreviated version of the full IP report, which can be obtained by contacting Virginia Department of Environmental Quality (VADEQ) or Virginia Department of Conservation and Recreation (VADCR) offices. Agency contact information can be found on the back of this pamphlet.

Review of TMDL Development Study

The Nottoway Study Area includes impaired segments of Beaverpond Creek, Nottoway River, Big Hounds Creek, and Little Nottoway River, and is located in Dinwiddie, Lunenburg, Nottoway, and Prince Edward counties. In 2004, the estimated human population within the Nottoway Study Area was 9758. The major land use within this area is forest (Figure 1).

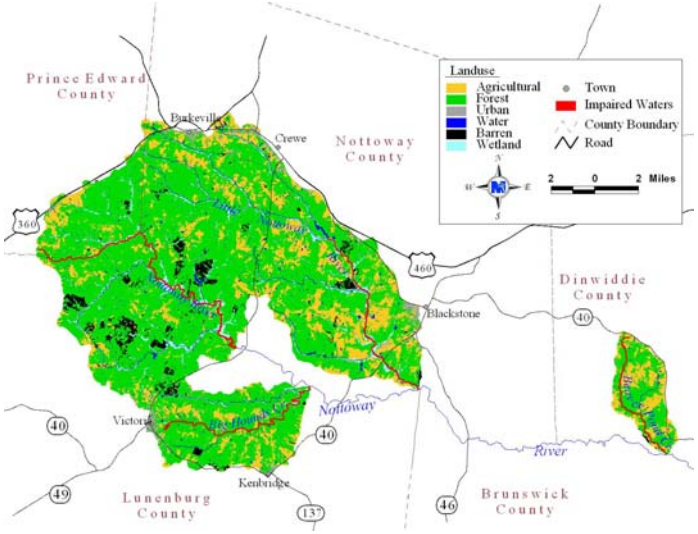

Figure 1. Land uses in the Nottoway Study Area.

Summary

- Industrial BMPs required
  - 73 Livestock Exclusion Systems
  - 71 Hardened Water Crossings
  - Improved Pasture Management
  - Manure/biosolids Incorporation/injection
  - Vegetated Buffers
  - Composting Facilities
  - Waste Storage Facilities

- Non-industrial BMPs required
  - 130 Straight Pipe Corrections
  - 569 Failing Septic System Repairs
  - 37 Dog Kennel BMPs
  - 1,392 acres treated by Retention Ponds
  - 144 acres treated by Infiltration Trenches

Contacts

30-day Public Comment Period

- Send written comments to:

BY JULY 27

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(Beaverpond Creek)	(Nottoway River and Big Hounds Creek)	(Nottoway River and Little Nottoway River)
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Education & Outreach

- Soil and Water Conservation Districts and FTEs
  - One-on-one communication
  - Field Days/Demonstrations
- Virginia Department of Health
  - Operation and maintenance of septic systems
- Virginia Cooperative Extension
  - Responds to specific needs of Virginia citizens

Stakeholder's Role in Implementation

- Participation
  - Prince Edward, Nottoway, Lunenburg, and Dinwiddie County Residents
  - Appomattox River, Southside, and Piedmont Soil and Water Conservation Districts
  - County Governments
  - VA Department of Environmental Quality
  - VA Department of Conservation and Recreation
  - VA Department of Health
  - VA Cooperative Extension
  - VA Department of Agricultural & Consumer Services
  - United States Environmental Protection Agency
  - USDA – Natural Resources Conservation Service

In addition to performing analyses of fecal bacteria and *E. coli* concentrations for the TMDL, MapTech, Inc. also conducted Bacterial Source Tracking (BST) in the Nottoway Study Area. BST is intended to aid in identifying sources (*i.e.*, human, pets, livestock, or wildlife) of fecal contamination in water bodies. The BST results provided insight into the likely sources of fecal contamination, aided in distributing fecal loads from different sources during model calibration, and will improve the chances for success in implementing solutions.

Table 1 summarizes the results for each station with load-weighted average proportions of bacteria originating from the four source categories. The load-weighted average considers the level of flow in the stream at the time of sampling, the concentration of *E. coli* measured, and the number of bacterial isolates analyzed in the BST analysis. A summary of the final allocations that resulted from the TMDL study is given in Table 2.

Process for Public Participation

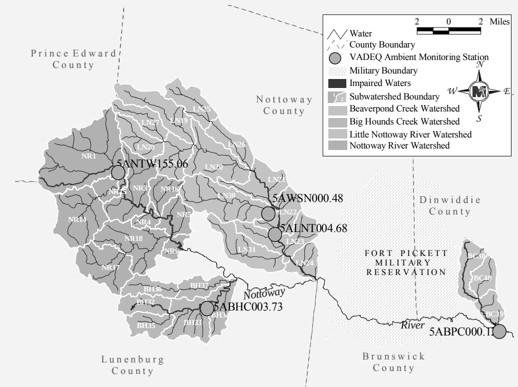
The actions and commitments described in this document are drawn together through input from citizens of the watershed, county governments, Virginia Department of Environmental Quality (VADEQ), Virginia Department of Conservation and Recreation (VADCR), Virginia Department of Health (VDH), Virginia Cooperative Extension (VCE), Natural Resources Conservation Service (NRCS), Appomattox River Soil and Water Conservation District (ARSWCD), Southside SWCD, Piedmont SWCD, and MapTech, Inc. Every citizen and interested party in the watershed area is encouraged to become involved in implementing the IP and contribute to the process that will restore the health of the streams.

Public participation took place on three levels. First, public meetings were held to inform the public of the end goals and status of the project, as well as provide a forum for soliciting participation in the smaller, more targeted meetings (*i.e.*, working groups and steering committee). Second, working

Table 1. Load-weighted average proportions of fecal bacteria originating from wildlife, human, livestock, and pet sources.

Station Name	Station ID	Weighted Averages				
		Human	Livestock	Pet	Anthropogenic (Human + Livestock + Pet)	Wildlife
Beaverpond Creek	5ABPC000.12	33%	12%	22%	**67%**	33%
Nottoway River	5ANTW155.06	2%	42%	28%	**72%**	28%
Little Nottoway River	5ALNT004.68	14%	20%	30%	**64%**	36%
Big Hounds Creek	5ABHC003.73	11%	28%	31%	**70%**	30%

VADEQ Monitoring



Benefits

- Economic Benefit
  - Local Economy & Community
  - Agricultural Producers
  - Homeowners

- Water Quality Benefits
  - Human Health
  - Environmental Benefit

10-Year Timeline

Costs

Year	Industrial BMPs ($)	Non-Industrial BMPs ($)	Technical Assistance ($)	Estimated Total Cost Per Year ($)
1	375,000	315,000	90,000	780,000
2	1,125,000	945,000	90,000	2,160,000
3	2,625,000	2,205,000	90,000	4,920,000
4	1,875,000	1,575,000	90,000	3,540,000
5	1,500,000	1,260,000	90,000	2,850,000
Total	**$7,500,000**	**$6,300,000**	**$450,000**	**$14,250,000**

Water Quality Milestones

Milestone	Date	Industrial Milestones		Non-Industrial Milestones		Water Quality Milestone: *E. coli* instantaneous water quality exceedances in			
		Livestock Exclusion Systems	NPS BMPs	Straight Pipes Corrected	NPS BMPs	Beaverpond Creek (%)	Nottoway River (%)	Big Hounds Creek (%)	Little Nottoway River (%)
Existing	8/1/2006	Implementation Begins				28.1	14.3	13.6	21.6
1	8/1/2007	5%	5%	5%	5%	27.78	13.81	11.51	20.6
2	8/1/2008	20%	20%	20%	20%	26.03	11.78	9.64	17.81
3	8/1/2009	55%	55%	55%	55%	20.82	8.66	6.3	11.07
4	8/1/2010	80%	80%	80%	80%	17.81	6.41	5.04	8.11
5	8/1/2011	100%	100%	100%	100%	15.4	5.53	4.22	5.81
6	8/1/2016	De-listing from 303(d) List				0	0	0	0

Table 2. Load reductions allocated during TMDL development for the Upper Nottoway River impairments.

Impairment	Percent Reduction in Loading from Existing Conditions					
	Direct Wildlife	NPS Forest / Wetland	Direct Live-stock	NPS Pasture / Livestock Ac-cess / Crops	Straight Pipe / Sewer Over-flow	NPS Res. / Urban
Beaverpond Creek	99.4	67	100	99.625	100	99
Nottoway River	21	86	100	99.9	100	99
Big Hounds Creek	0	81	100	99	100	91
Little Nottoway River	67	95	100	99	100	99

groups were assembled from communities of people with common concerns regarding the implementation process. These were the primary arena for public input. The working groups were: Industrial (agricultural and industry) and Non-industrial (residents, environmental group representatives, and government representatives). A representative from VADEQ and MapTech attended each working group meeting in order to facilitate the process and integrate information collected from the various communities. Third, a steering committee was formed with representation from all of the working groups, VADEQ, VADCR, VDH, and MapTech, and had the express purpose of guiding the development of the IP. Many work-hours were devoted to attending these meetings by individuals representing agricultural, residential, commercial, environmental, and government interests on a local, state, and federal level.

Throughout the public participation process, major emphasis was placed on discussing best management practices (BMPs), BMP specifications, locations of control measures, education, technical assistance, and funding.

Working Groups and Steering Committee

The Industrial Working Group (IWG) consisted of representatives from VCE, Southside SWCD, Piedmont SWCD, VADEQ, and MapTech.

The Non-industrial Working Group (NIWG) was made up of representatives from VADEQ, Department of Forestry, Dinwiddie County VDH, Nottoway County VDH, and MapTech.

The Steering Committee consisted of representatives from the Industrial and Non-industrial Working Groups, VADEQ, VADCR, Prince Edward County Planning Commission, Southside SWCD, Appomattox River SWCD, NRCS, and MapTech. The Steering Committee discussed implementation needs, potential funding resources available, and how to get more participation from producers.

Funding Sources

Livestock System: Example Scenario 2

If regulatory authority or court action forces participation:

System Cost	$10,000
Design Cost	$1,600
0% Assistance Funded	-$0
0% Cost-Share	-$0
0% Tax Credit	-$0
Cost to Landowner	**$ 11,600**

5-Year Timeline

Implementation and Technical Assistance

Year	Industrial BMPs (%)	Non-Industrial BMPs (%)	Industrial Technical FTEs (#)	Non-Industrial Technical FTEs (#)
1	5%	5%	2	1
2	15%	15%	2	1
3	35%	35%	2	1
4	25%	25%	2	1
5	20%	20%	2	1
Total	**100%**	**100%**	**10**	**5**

Funding Sources

- Many funding sources available
  - EPA - 319 Incremental Funding
  - USDA - EQIP
  - USDA - CREP
  - Virginia Ag. BMP Cost-Share Program
  - Virginia Ag. BMP Tax Credit Program
  - Virginia Water Quality Improvement Fund
  - Virginia Revolving Loan Programs

Funding Sources

Livestock System: Example Scenario 1

319 & VA State Cost-Share Programs:

System Cost	$10,000
Design Cost (SWCD/FTE assistance)	$1,600
100% Assistance Funded (319 Incremental Funds)	-$1,600
75% Cost-Share	-$7,500
25% Tax Credit	-$625
Cost to Landowner	**$1,875**

Assessment of Needs

Industrial BMPs

The quantity of streamside fencing required during implementation was determined through spatial analyses of land use, stream network, and the USDA Common Land Unit Layer (CLU) along with regionally appropriate data archived in the VADCR Agricultural BMP Database and TMDL development documents. The map layers and archived data were combined to establish estimates of control measures required overall, in the watershed, and in each subwatershed. Additionally, input from local agency representatives and contractors were used to verify the analyses. There are approximately 255 miles of perennial and intermittent streams in the Nottoway Study Area. The length of fencing required on perennial and intermittent streams in the Nottoway Study Area is approximately 82,588 feet. There are 55 Grazing Land Protection Systems (SL-6) and 15 Stream Protection Systems (WP-2) required to be installed to ensure full exclusion of livestock from the streams. Estimates of all industrial BMPs needed for full implementation in the watershed are listed in Table 3.

Non-industrial BMPs

All failing septic systems and straight pipes must be identified and replaced during implementation since a 100% load reduction from direct and nonpoint source (NPS) human waste is required to meet the TMDL goal. The estimated

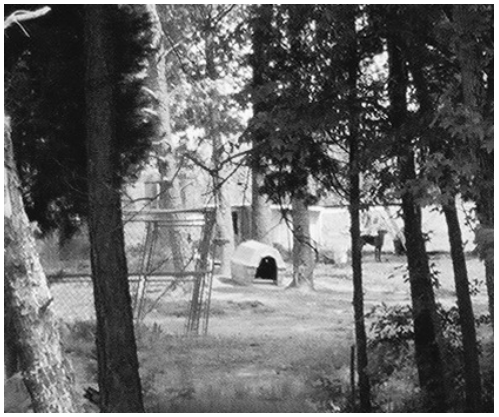
numbers of straight pipes and failing septic systems were reported in the TMDL and are shown in Table 3.

To deal with the NPS loads from dog waste in the Upper Nottoway River Basin, the NIWG and the Steering Committee decided that the number of dog kennels should be estimated as these operations require BMPs to reduce fecal bacteria from dog waste from entering surface waters. The estimated numbers of these are shown in Table 3.

Full-Time Equivalents (FTEs)

To determine the number of FTE considered necessary for industrial technical assistance during implementation, the number of BMPs required per year was divided by the number of BMPs that one FTE can process in a year. The number of FTE required was calculated from historical work records. As a result, 2.0 industrial technical FTEs are needed to provide technical assistance throughout implementation of BMPs in the Nottoway Study Area .

The Steering Committee decided that one Technical FTE will be required to carry out the non-industrial IP aspects.



Livestock System Costs

Alternative Water Source	$1,000 – $10,000
1,000 ft Streamside Fencing	$1,500 – $4,000
TOTAL	**$2,500 – $14,000**

Residential Waste Treatment System Costs

Standard Septic System	**$3,000 - 6,000**
Alternative System	**$10,000 - 20,000**
Failing Septic System Repair	**$3,000**

Assessment of Needs

Technical Assistance

- Industrial (agricultural) Program
  - Soil & Water Conservation Districts
  - 2 Full-Time Employees (FTE)
    - Distributed to each SWCD
- Non-Industrial (residential) Program
  - 1 Full-Time Employee (FTE)

Estimated Total Cost

Industrial Practices	**$7,500,000**
Non-Industrial Practices	**$6,300,000**
Technical Assistance	**$450,000**
TOTAL	**$14,250,000**

Approximately $2,850,000 annually

Table 3 Control measures (BMPs) required in the Nottoway Study Area.

Control Measure	Unit	Estimated Unit Needs (#)	Average Cost/Unit ($)[1]
Industrial			
Full Exclusion System (SL-6)	system	55	44,500
Stream Protection (WP-2T)	system	15	24,700
Hardened Crossings	systems	71	6,900
Manure/biosolids Incorporation/injection	acre	9,795	18
Improved Pasture Management	acre	18,145	170
Vegetated Buffers (35 ft wide)	feet	4,226	0.56
Waste Storage Facility	system	7	20,000
Composting Facility	system	5	4,100
Industrial Technical & Administrative Assistance		2.0	30,000
Non-industrial			
On-site Waste Treatment System Installation to Correct Straight Pipes	system	130	9,000[2]
Correction of Failing Septic Systems	system	569	3,000
Dog kennel BMPs	system	37	1,200
Infiltration Trenches	acre	144	9,000
Retention Ponds	acre	1,392	2,000
Non-industrial Technical & Administrative Assistance		1.0	30,000

[1]All costs are an average of costs for Beaverpond Creek, Nottoway River, Big Hounds Creek, and Little Nottoway River

[2] Cost represents average of standard septic system and alternative waste treatment system.

Implementation

Potential funding sources available during implementation were identified during plan development. Detailed description of each source can be obtained from the SWCDs, VADCR, NRCS, VCE, and VADEQ. Sources include:

- Federal Clean Water Act Section 319 Increment Funds
- Virginia Agricultural Best Management Practices Cost-Share Program
- Virginia Agricultural Best Management Practices Tax Credit Program
- USDA Environmental Quality Incentives Program (EQIP)
- Virginia Revolving Loan Programs (Agricultural BMPs and onsite sewage disposal systems)
- Virginia Water Quality Improvement Fund
- USDA Conservation Reserve Enhancement Program (CREP)

One possible scenario for funding in the first year is presented in Table 4. This scenario represents 5% installation of both industial and non-industrial BMPs, and 3.0 technical FTEs.

Assessment of Needs

Industrial (agricultural) BMPs

- Livestock Exclusion
  - 15.6 miles of Streamside Fencing
  - 73 livestock exclusion systems
  - 71 Hardened Water Crossings
- Nonpoint Source (NPS) BMPs
  - 18,145 acres of Improved Pasture Management
  - 9,795 acres of Manure/biosolids Incorporation/injection
  - 4,226 acres of Vegetated Buffers
  - 7 Composting Facilities
  - 5 Waste Storage Facilities

Assessment of Needs

Non-industrial (residential) BMPs

- 130 Straight Pipe Corrections
- 569 Failing Septic System Repairs
- 37 Dog Kennel BMPs
- 144 acres treated by Infiltration Trenches
- 1,392 acres treated by Retention Ponds
- 1 Residential Education Program

Public Participation

- **Public Meetings (2)**
  - January 12, 2005
  - June 27, 2005
- **Steering Committee Meetings (2)**
- **Working Groups**
  - Industrial (2)
  - Non-industrial (2)

- **Summary**
  - Increasing Participation
  - Types of BMPs
  - Education and Technical Assistance
  - Funding
  - Timeline and Milestones

Assessment of Needs

- Identification of BMPs
- Quantification of BMPs
  - Spatial Analysis
  - BMP Database Analysis
  - Input from Working Groups
- Technical Assistance and Education
  - BMP Database Analysis
  - Input from Steering Committees

Table 4. One possible scenario for funding costs for 20% of implementation.

	Landowner	Cost-Share	Total
Industrial BMPs	$210,738	$217,141	$427,879
Incentives	-$40	$40	$0
Non-industrial BMPs	$313,083	$0	$313,083
Dog Kennel BMPs	$2,220	$0	$2,220
FTEs	$0	$90,000	$90,000
Total	*$526,001*	*$307,181*	*$833,182*

Implementation is scheduled to begin in July 2006 after which five milestones need to be met over the next five years. The first milestone will be one year after implementation begins, whereby 5% of the industrial BMPs and 5% of the non-industrial BMPs will be installed with expected reductions in violations of the *E. coli* water quality standards. The five year milestone will be 100% of all required BMPs installed. Compliance with the *E. coli* bacteria standard will be anticipated five years after full implementation, to allow for lag time in BMP effectiveness and stabilization of bacteria populations in the streams. If, prior to the 5-year milestone, water quality improves to the point that Beaverpond Creek, Nottoway River, Big Hounds Creek and/or Little Nottoway River can be de-listed (10.5% or less violation rate of the instantaneous standard), the Steering Committee will evaluate the cost-share requests and monitoring data and determine whether to revise the project timeline.

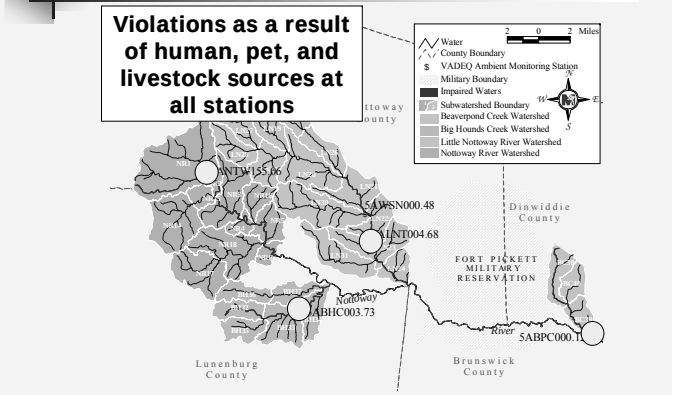
The milestone are 5%, 15%, 35%, 25%, and 20% for implementation per year. Based on meeting the milestones, a five-year implementation plan outline was formulated as depicted in Table 5.

Following the idea of a staged implementation approach it is suggested to concentrated resources and finances on streamside fencing, straight pipe corrections and dog kennel BMP installations in the first year. With the installation of streamside fencing direct livestock fecal loads are reduced 100% and buffers are established between fencing and the stream. Correcting straight pipes is an important component of this IP due to the health risks associated with contacting pathogens from human wastes. The bacterial source tracking (BST) results indicated that dog wastes are a large source of fecal pollution in these streams. Concentrating on implementing streamside fencing, straight pipe corrections and dog kennel BMPs within the first year may provide the highest return on water quality improvement with less cost to landowners.

Chowan Study Area TMDL Summary

- 100% of cattle must be fenced out of streams
- 100% of straight pipes must be corrected
- Failing septic systems must be repaired
- Dog waste must be disposed of properly
- Bacteria in runoff from agricultural lands must be prevented

Chowan Study Area TMDL Summary
Bacterial Source Tracking (BST) Results



Total Maximum Daily Load

Maximum amount of pollutant that a water body can assimilate without surpassing state water quality standard.

Presentation Outline

1. Chowan Study Area TMDL Summary
2. Public Participation
3. Assessment of Needs
4. Cost/Benefit Analysis
5. Implementation

Table 5. Implementation and water quality milestones for the Nottoway Study Area impairments..

	Implementation Milestone			Water Quality Milestone: *E. coli* instantaneous water quality exceedances in			
Mile-stone	Date	Industrial BMPs	Non-industrial BMPs	Beaverpond Creek (%)	Nottoway River (%)	Big Hounds Creek (%)	Little Nottoway River (%)
Existing	8/1/2005	Implementation Begins		28.1	14.3	13.6	21.6
1	8/1/2006	5%	5%	27.78	13.81	11.51	20.60
2	8/1/2007	20%	20%	26.03	11.78	9.64	17.81
3	8/1/2008	55%	55%	20.82	8.66	6.3	11.07
4	8/1/2009	80%	80%	17.81	6.41	5.04	8.11
5	8/1/2010	100%	100%	15.40	5.53	4.22	5.81
6	8/1/2015	De-listing from 303(d) List		0	0	0	0

*****The subwatershed locations are shown in Figure 3.

Implicit in the process of a staged implementation is targeting of control measures. The purpose of targeting is to identify subwatersheds where initial implementation resources would result in the greatest return in water quality improvement. Targeting ensures optimum utilization of resources. Targeting of critical areas for BMP installation was accomplished through analysis of land use, farm boundaries, stream network GIS layers, and monitoring results. Tables 6 and 7 show the subwatershed order for targeting streamside fencing and straight pipe corrections in the impairments in the Nottoway Study Area. The subwatersheds of the Nottoway Study Area are shown in Figure 2.

Table 6. Subwatershed order for targeting straight corrections.

Impairment	Straight Pipe Correction Targeting Subwatershed Order
Big Hounds Creek (BH)	32, 33, 35, 34
Nottoway River (NR)	1, 3, 17, 5, 18, 14, 16, 6, 2, 4, 15
Little Nottoway River (LN)	25, 20, 26, 30, 19, 21, 28, 29, 22, 23, 31, 27, 24
Beaverpond Creek (BC)	38, 40, 39

Table 7. Subwatershed order for targeting streamside fencing BMPs.

Impairment	Streamside Fencing Targeting Subwatershed Order
Big Hounds Creek (BH)	36, 37, 35, 32, 34, 33
Nottoway River (NR)	16, 4, 18, 1, 3, 17, 2, 5, 14, 15, 6
Little Nottoway River (LN)	29, 19, 26, 21, 30, 23, 31, 25, 20, 28, 24, 22, 27
Beaverpond Creek (BC)	39, 38, 40

Chowan Study Area TMDL Implementation Plan Development

Upper Nottoway River Impairments

June 27, 2005

Acknowledgements

Steering Committee Members
Working Group Members
&
Piedmont, Appomattox River, and Southside Soil & Water Conservation Districts
VADEQ and VADCR
County Government

NOTES

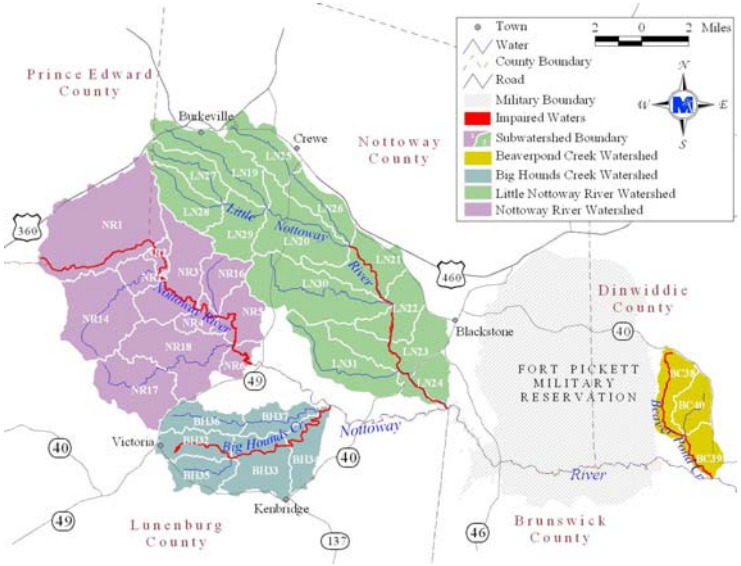


Figure 2. The location of the Nottoway Study Area subwatersheds and impairments.

Cost / Benefit Analysis

Associated cost estimates of industrial BMPs were calculated by multiplying the unit cost by the number of units in each subwatershed (Table 3). As depicted in Table 8, the amount needed to install all industrial control measures is $7.50 million.

Cost estimations to replace straight pipes were based on the combination of new septic systems or alternative waste treatment systems. The costs of the non-industrial BMPs were calculated using values from Table 3. The total cost estimated for all required non-industrial BMPs is $6.30 million.

It was determined by the SWCDs and the Steering Committee that it would require $30,000 to support the salary, benefits, travel, training, and incidentals for education of one technical FTE. With quantification analysis yielding a need for two technical industrial FTEs per year and one non-industrial FTEs per year, the maximum total cost to provide technical assistance during implementation is expected to be $1450,000 over 5 years (Table 8).

Table 8. Estimated total cost of BMPs and technical assistance needed in the Upper Nottoway River Basin.

The primary benefit of implementation is cleaner waters in Virginia. Specifically, fecal contamination in Beaverpond Creek, Nottoway River, Big Hounds Creek, and Little Nottoway River will be reduced to meet water quality standards. It is hard to gauge the impact that reducing fecal contamination will have on public health, as most cases of waterborne infection are not reported or are falsely attributed to other sources. However, because of the reductions required, the incidence of infection from fecal sources, through contact with surface waters, should be considerably reduced.

List of Acronyms

BMP	Best Management Practice
CLU	Common Land Unit
CREP	Conservation Reserve and Enhancement Program
CWA	Clean Water Act
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentive Program
FTE	Full Time Equivalent
IP	Implementation Plan
IWG	Industrial Working Group
NIWG	Non-Industrial Working Group
NPS	Non Point Source Pollution
NRCS	Natural Resources Conservation Service
SL-6	Grazing Land Protection System
SWCD	Soil and Water Conservation District
TMDL	Total Maximum Daily Load
VADCR	Virginia Department of Conservation and Recreation
VADEQ	Virginia Department of Environmental Quality
VCE	Virginia Cooperative Extension
VDACS	Virginia Department of Agriculture and Consumer Services
VDH	Virginia Department of Health
WP-2	Streambank Protection

addition, citizens have the right to bring litigation against persons or groups of people who can be shown to be causing some harm to the claimant. Through hearing the claims of citizens in civil court, and the claims of government representatives in criminal court, the judicial branch of government also plays a significant role in the regulation of activities that impact water quality.

Successful implementation depends on stakeholders taking responsibility for their role in the process. While the primary role falls on the landowner, local, state and federal agencies also have a stake in seeing that Virginia's waters are clean and provide a healthy environment for its citizens. An important first step in correcting the existing water quality problem is recognizing that there *is* a problem and that the health of citizens is at stake. While it is unreasonable to expect that the natural environment (*e.g.,* streams and rivers) can be made 100% free of risk to human health, it is possible and desirable to minimize manmade problems. Virginia's approach to correcting NPS pollution problems has been, and continues to be, encouragement of participation through education and financial incentives. However, if progress is not made toward restoring water quality using this voluntary approach, regulatory controls may established and enforced.

Table 8. Estimated total cost for full implementation in the Nottoway Study Area.

Year	Industrial BMPs ($)	Non-Industrial BMPs ($)	Technical Assis-tance ($)	Estimated Total Cost Per Year ($)
1	375,000	315,000	90,000	780,000
2	1,125,000	945,000	90,000	2,160,000
3	2,625,000	2,205,000	90,000	4,920,000
4	1,875,000	1,575,000	90,000	3,540,000
5	1,500,000	1,260,000	90,000	2,850,000
Total	**$7,500,000**	**$6,300,000**	**$450,000**	**$14,250,000**

Additionally, because of streambank protection that will be provided through exclusion of livestock from streams, the aquatic habitat will be improved in these waters. The vegetated buffers that are established will also serve to reduce sediment and nutrient transport to the stream from upslope locations. In areas where pasture management is improved, soil and nutrient losses should be reduced and infiltration of precipitation should be increased, decreasing peak flows downstream.

An important objective of the implementation plan is to foster continued economic vitality and strength. This objective is based on the recognition that healthy waters improve economic opportunities for Virginians, and a healthy economic base provides the resources and funding necessary to pursue restoration and enhancement activities. The agricultural and residential practices recommended in this document will provide economic benefits, as well as the expected environmental benefits, to the landowner. Specifically, alternative (clean) water sources, exclusion of livestock from streams, intensive pasture management, and private sewage system maintenance will each provide economic benefits.

A clean water source has been shown to improve weight gain and milk production in cattle. Fresh clean water is the primary nutrient for livestock. Healthy cattle consume, on a daily basis, close to 10% of their body weight during winter and 15% of their body weight in summer. Many livestock illnesses can be spread through contaminated water supplies. Coccidia, for example, can be delivered through feed, water and haircoat that has been contaminated with manure (VCE, 2000). In addition, horses drinking from marshy areas or areas accessible to wildlife or cattle that are carrying leptospirosis, tend to have an increased incidence of moonblindness associated with leptospirosis infections (VCE, 1998b). A clean water source can prevent illnesses that reduce production and incur the added expense of avoidable veterinary bills. In addition to reducing the likelihood of animals contracting waterborne illnesses by

of voluntary partial participation and not the TMDL-required 100% participation of stakeholders. To meet the needs of the TMDL program and achieve the goals set forth in the CWA, the incentive programs must be reevaluated to account for 100% participation. It should be noted that VADCR does not have regulatory authority over the majority of NPS issues addressed here.

Through Virginia's Agricultural Stewardship Act, VDACS Commissioner of Agriculture has the authority to investigate claims that an agricultural producer is causing a water quality problem on a case-by-case basis (Pugh, 2001). If deemed a problem, the Commissioner can order the producer to submit an agricultural stewardship plan to the local soil and water conservation district. If a producer fails to implement the plan, corrective action can be taken which can include a civil penalty up to $5,000 per day. The Commissioner of Agriculture can issue an emergency corrective action if runoff is likely to endanger public health, animals, fish and aquatic life, public water supply, etc. An emergency order can shut down all or part of an agricultural activity and require specific stewardship measures. The enforcement of the Agricultural Stewardship Act is entirely complaint-driven.

VDH is responsible for maintaining safe drinking water measured by standards set by EPA. Their duties also include septic system regulation and, historically, regulation of biosolids land application. Like VDACS, VDH's program is complaint-driven. Complaints can range from a vent pipe odor that is not an actual sewage violation and takes very little time to investigate, to a large discharge violation that may take many weeks or longer to effect compliance. In the scheme of this TMDL IP, VDH has the responsibility of enforcing actions to correct or eliminate failed septic systems and straight pipes, respectively.

State government has the authority to establish state laws that control delivery of pollutants to local waters. Local governments, in conjunction with the state, can develop ordinances involving pollution prevention measures. In

first acknowledge there *is* a water quality problem, and then make the needed changes in our operations, programs, and legislations to address these pollutants.

The EPA has the responsibility for overseeing the various programs necessary for the success of the Clean Water Act. However, administration and enforcement of such programs falls largely to the states. In the Commonwealth of Virginia, water quality problems are dealt with through legislation, incentive programs, education, and legal actions. Currently, there are four state agencies responsible for regulating activities that impact water quality with regard to this implementation plan. These agencies include: Virginia Department of Environmental Quality (VADEQ), Virginia Department of Conservation and Recreation (VADCR), Virginia Department of Agriculture and Consumer Services (VDACS), and Virginia Department of Health (VDH).

VADEQ has responsibility for monitoring the waters to determine compliance with state standards, and for requiring permitted point dischargers to maintain loads within permit limits. They have the regulatory authority to levy fines and take legal action against those in violation of permits. Beginning in 1994, animal waste from confined animal facilities in excess of 300 animal units (cattle and hogs) has been managed through a Virginia general pollution abatement permit. These operations are required to implement a number of practices to prevent groundwater contamination. In response to increasing demand from the public to develop new regulations dealing with animal waste, in 1999 the Virginia General Assembly passed legislation requiring VADEQ to develop regulations for the management of poultry waste in operations having more than 200 animal units of poultry (about 20,000 chickens) (ELI, 1999).

VADCR holds the responsibility for addressing nonpoint sources (NPS) of pollution. Historically, most VADCR programs have dealt with agricultural NPS pollution through education and voluntary incentive programs. These cost-share programs were originally developed to meet the needs

providing a clean water supply, streamside fencing excludes livestock from wet, swampy environments as are often found next to streams where cattle have regular access. Keeping cattle in clean, dry areas has been shown to reduce the occurrence of mastitis and foot rot. The Virginia Cooperative Extension (1998a) reports that mastitis currently costs producers $100 per cow in reduced quantity and quality of milk produced. On a larger scale, mastitis costs the U.S. dairy industry about $1.7 - 2 billion annually, or 11% of total U.S. milk production. While the spread of mastitis through a dairy herd can be reduced through proper sanitation of milking equipment, mastitis-causing bacteria can be harbored and spread in the environment where cattle have access to wet and dirty areas. Implementation of streamside fencing and well-managed loafing areas will reduce the amount of time that cattle have access to these areas.

Taking the opportunity to initiate an improved pasture management system in conjunction with installing clean water supplies will also provide economic benefits for the producer. Improved pasture management can allow a producer to feed less hay in winter months, increase stocking rates by 30 - 40% and, consequently, improve the profitability of the operation. With feed costs typically responsible for 70 - 80 percent of the cost of growing or maintaining an animal, and pastures providing feed at a cost of 0.01-0.02 cents/lb of total digestible nutrients (TDN) (compared to 0.04-0.06 cents/lb TDN for hay), increasing the amount of time that cattle are fed on pasture is clearly a financial benefit to producers (VCE, 1996). Standing forage utilized directly by the grazing animal is always less costly and of higher quality than the same forage harvested with equipment and fed to the animal. In addition to reducing costs to producers, intensive pasture management can boost profits by allowing higher stocking rates and increasing the amount of gain per acre. A side benefit is that cattle are more closely confined, allowing for quicker checking and handling. In general, many of the agricultural BMPs being recommended will provide both environmental benefits and economic benefits to the farmer.

The non-industrial programs will play an important role in improving water quality, since human waste can carry human viruses in addition to the bacterial and protozoan pathogens that all fecal matter can potentially carry with it. In terms of economic benefits to homeowners, an improved understanding of private sewage systems (including knowledge of what steps can be taken to keep them functioning properly and the need for regular maintenance) will give homeowners the tools needed for extending the life of their systems and reducing the overall cost of ownership. The average septic system will last 20 - 25 years if properly maintained. Proper maintenance includes: knowing the location of the system components and protecting them (e.g., not driving or parking on top of them, not planting trees where roots could damage the system), keeping hazardous chemicals out of the system, and pumping out the septic tank every three to five years. The cost of proper maintenance, as outlined here, is relatively inexpensive in comparison to repairing or replacing the entire system.

Monitoring

Progress toward end goals will be assessed during implementation through tracking of control measure installations by the SWCDs, VDH and VADEQ, and continued water quality monitoring.

The success of the implementation measures will be determined by monitoring conducted by VADEQ through the agency's monitoring program. VADEQ will monitor at 5 monitoring locations in the Nottoway Study Area. All of the stations will be monitored on a monthly basis during implementation.

Education

Personnel from the Appomattox River, Southside, and Piedmont SWCDs, along with the industrial FTEs, will initiate contact with farmers in the Nottoway Study Area to encourage the installation of industrial BMPs. This one-on-one contact will facilitate communication of the water

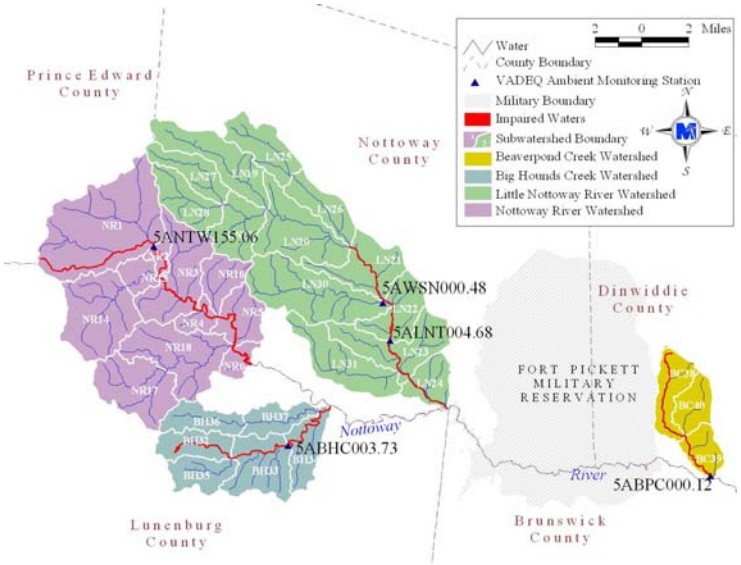


Figure 3. VADEQ Monitoring Stations in the Nottoway study area..

quality problems and the corrective actions needed. The FTEs will conduct a number of outreach activities in the watershed to encourage community support and participation in reaching the industrial program milestones, and to make the agricultural community aware of the TMDL requirements. Such activities will include information exchange through newsletters, mailings, field days, organizational meetings, etc. The FTEs will work with organizations (such as Virginia Cooperative Extension) to educate the public.

Stakeholders' Roles and Responsibilities

Achieving the goals of this effort (*i.e.*, improving water quality and removing these waters from the impaired waters lists) is dependent on stakeholder participation. Both the local stakeholders charged with implementation of control measures and the stakeholders charged with overseeing our nation's human health and environmental programs must